8-BIT PARALLEL IN/OUT DARLINGTON SOURCE DRIVER WITH LATCH

Check for Samples: TLC59213, TLC59213A

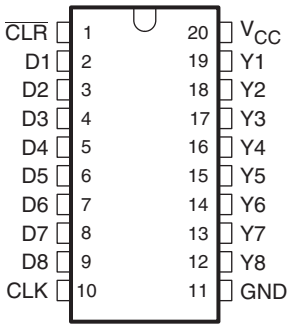
FEATURES

- **Output Current on Each Channel (I_{OUT} Max = –500 mA)**
- **$V_{CE(sus)}$ = 13.2 V**
- **Input Compatible With TTL/5-V CMOS**
- **Clear ($\overline{CLR}$) and Clock (CLK) TTL/CMOS Control Inputs**
- **CLR Control Input to Off the Output**
- **Darlington Source Driver**
- **Clock Input Up to 1 MHz**
- **Enhanced Hold Time (t_h) on TLC59213A**
- **Temperature Range: –40°C to 85°C**

APPLICATIONS

- **Lamp and Display (LED)**
- **Hammer**
- **Relay**

N OR PW PACKAGE
(TOP VIEW)



DESCRIPTION

The TLC59213 and TLC59213A are 8-bit source drivers with input latch with CLK input and $\overline{CLR}$ to set the output OFF. The TLC59213 and TLC59213A have large output source currents up to 500 mA with Darlington transistor and collectors tied to V_{CC}. These feature make the device optimum level of driving the matrix of ink jet printer head, LEDs, and the scan-side of resistor's matrix. The TLC59213 and TLC59213A differ only in the Data Hold Time Specification (t_h).

The clamp diode is between output and ground for switching inductive load.

All inputs are TTL/CMOS, which enable to any logic-level inputs such as MCU, CPU or SN74LV594 (serial to parallel) and the output enable LED matrix display. It can also be used with another device sink driver such as TLC59210, TLC59211 and TLC59212.

ORDERING INFORMATION(1)

T_A	PACKAGE(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube of 20	TLC59213IN	TLC59213IN
	TSSOP – PW	Reel of 2000	TLC59213IPWR	Y59213
	PDIP – N	Tube of 20	TLC59213AIN	TLC59213AIN
	TSSOP – PW	Reel of 2000	TLC59213AIPWR	Y59213A
		Reel of 250	TLC59213AIPWT	

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

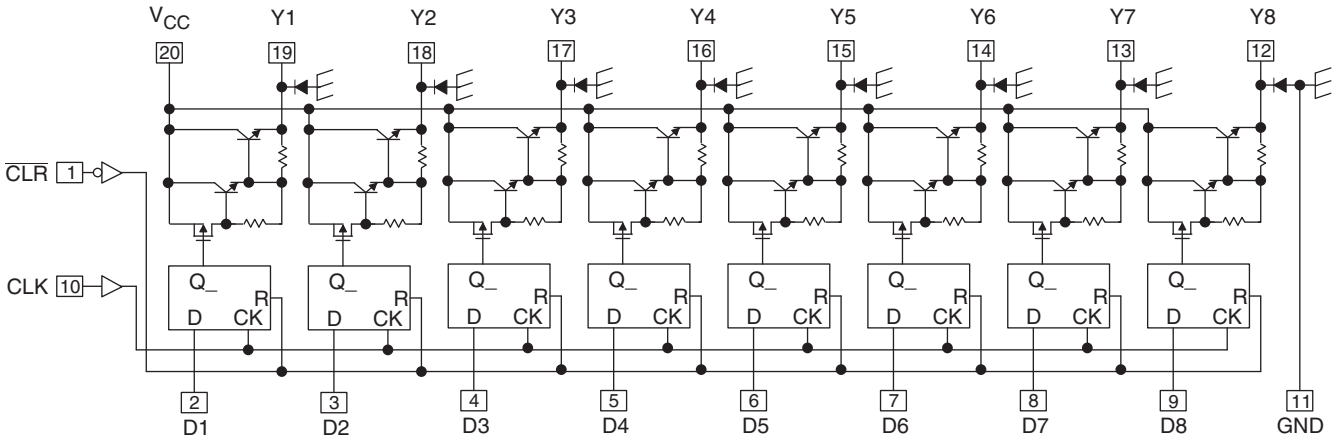
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

FUNCTION TABLE (EACH LATCH)(1)

INPUTS			OUTPUT
$\overline{CLR}$	CLK	D	Y
L	X	X	Z (OFF)
H	↑	L	Z (OFF)
H	↑	H	H (ON)
H	L	X	Y_0
H	↓	X	Y_0

(1) L: Low-level
H: High-level
X: Irrelevant
↑: Rising edge
↓: Falling edge
Z : High-impedance (off)

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS(1)

over operating free-air temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V_{DD}	Supply voltage range		–0.5	15	V
V_I	Input voltage range		–0.5	V_{CC} + 0.5	V
	Collector-emitter voltage		–0.5	15	V
I_O	Peak output current			–500	mA
I_{IK}	Input clamp current	V_I < 0 V		–20	mA
I_{OK}	Output clamp current	V_O < 0 V		–500	mA
θ_{JA}	Package thermal impedance(2)	N package		69	°C/W
		PW package		83	
T_{stg}	Storage temperature range		–65	150	°C

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS

		CONDITIONS		MIN	MAX	UNIT
V_{CC}	Supply voltage			4.5	13.2	V
V_{IH}	High-level input voltage			2		V
V_{IL}	Low-level input voltage				0.8	V
I_O	Output current (8 channel)	N package	Duty cycle < 10%		400	mA
			Duty cycle < 50%		200	
		PW package	Duty cycle < 10%		350	
			Duty cycle < 50%		170	
T_A	Operating free-air temperature			–40	85	°C

ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
I_{CEX}	Output leakage current	V_{CC} = 13.2 V, Outputs off				2	µA
$V_{CE(sus)}$	Output saturation voltage	I_{OUT} = –350 mA				2.35	V
		I_{OUT} = –225 mA				2.15	
		I_{OUT} = –100 mA				1.96	
I_I	Input current	V_{CC} = 13.2 V, V_I = 0 or 13.2 V				1	µA
V_f	Clamp forward voltage	I_f = –350 mA		–2			V
I_{CC}	Supply current	V_{CC} = 13.2 V, V_I = 0 or 13.2 V	All outputs OFF		4.6	13	mA
			All outputs ON		4.8	13	
C_I	Input capacitance					10	pF

TIMING REQUIREMENTS

over recommended operating free-air temperature range (unless otherwise noted), see Figure 3

PARAMETER				TEST CONDITIONS	MIN	MAX	UNIT
t_{su}	Setup time	D before CLK ↑			50		ns
		$\overline{CLR}$ high before CLK ↑			50		ns
t_h	Hold time	D after CLK ↑	TLC59213, TLC59213A	T_A = -40°C to 85°C	50		ns
			TLC59213	T_A = 0°C to 70°C	25		
			TLC59213A	T_A = 0°C to 70°C, V_{CC} = 4.5 V to 5.5 V	15		
				T_A = 0°C to 70°C, V_{CC} = 10.8 V to 13.2 V	19		
t_w	Pulse width	CLK, $\overline{CLR}$			100		ns

SWITCHING CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted), see Figure 3

PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	T_A = 25°C			T_A = –40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
t_{PLH}	Propagation delay time, low-to-high level output	CLK	Y	RL = 25 Ω, C_L = 15 pF		107	200		250	ns
t_{PHL}	Propagation delay time, high-to-low level output	CLK	Y	RL = 25 Ω, C_L = 15 pF		111	200		250	ns
t_{PHLR}		$\overline{CLR}$	Y			104	200		250	

THERMAL INFORMATION

MAXIMUM OUTPUT CURRENT vs DUTY CYCLE

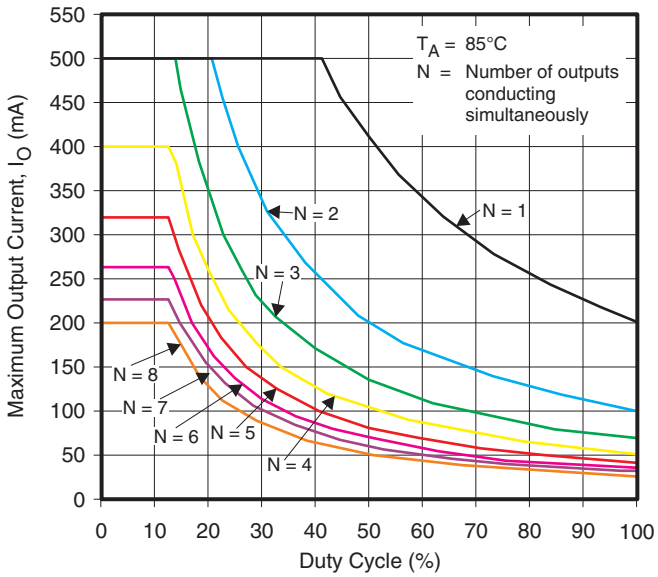


Figure 1. TSSOP (PW) PACKAGE

MAXIMUM OUTPUT CURRENT vs DUTY CYCLE

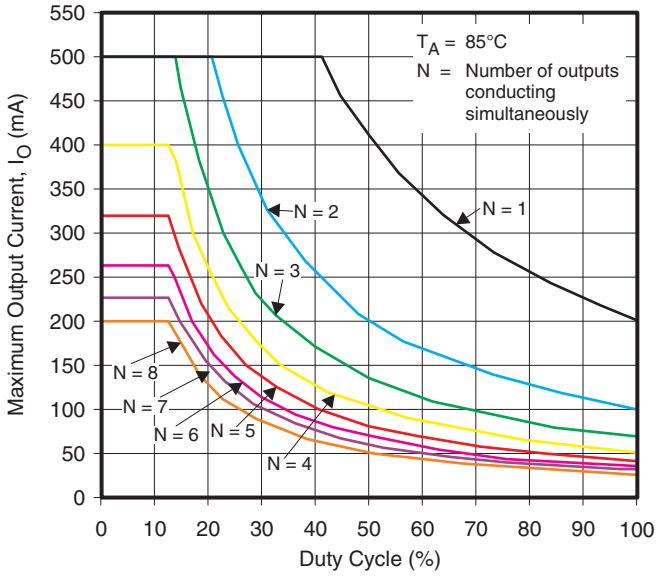
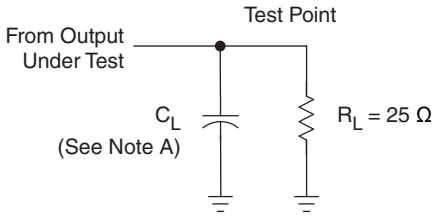
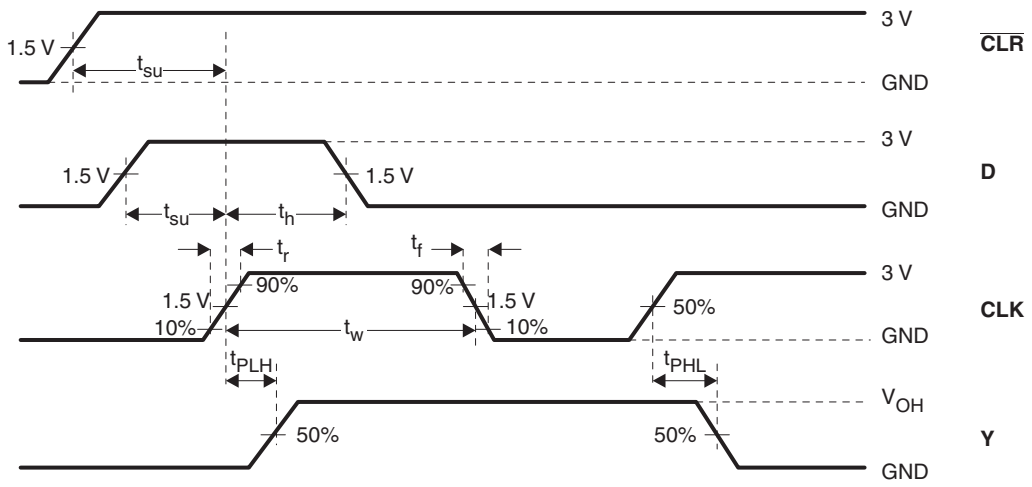


Figure 2. DIP (N) PACKAGE

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

A. C_L includes probe and jig capacitance.

B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, and t_f ≤ 3 ns.

C. The outputs are measured one at a time with one transition per measurement.

Figure 3. Test Circuit and Voltage Waveforms

APPLICATION INFORMATION

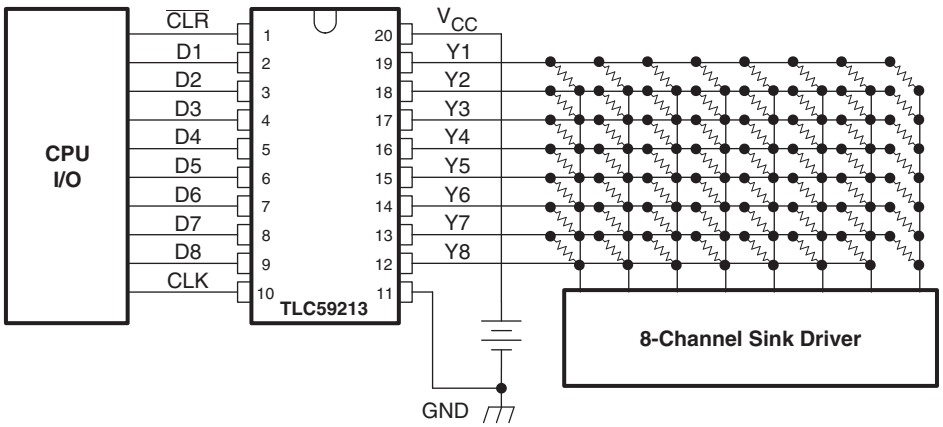


Figure 4. Example of LED Display Connection

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
TLC59213AIN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
TLC59213AIPWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLC59213AIPWT	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLC59213IN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
TLC59213IPWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

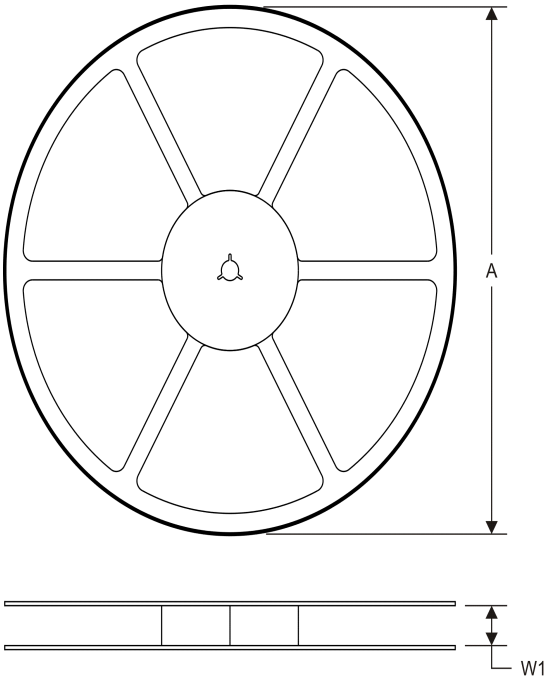
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

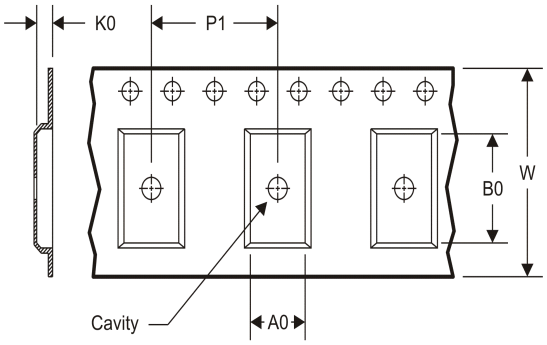
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



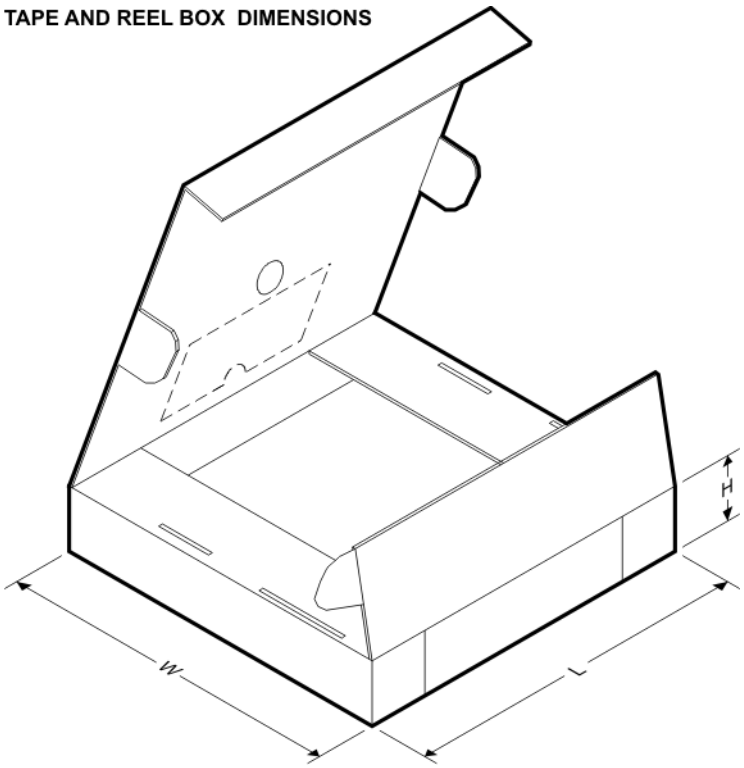
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TLC59213AIPWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
TLC59213AIPWT	TSSOP	PW	20	250	180.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
TLC59213IPWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

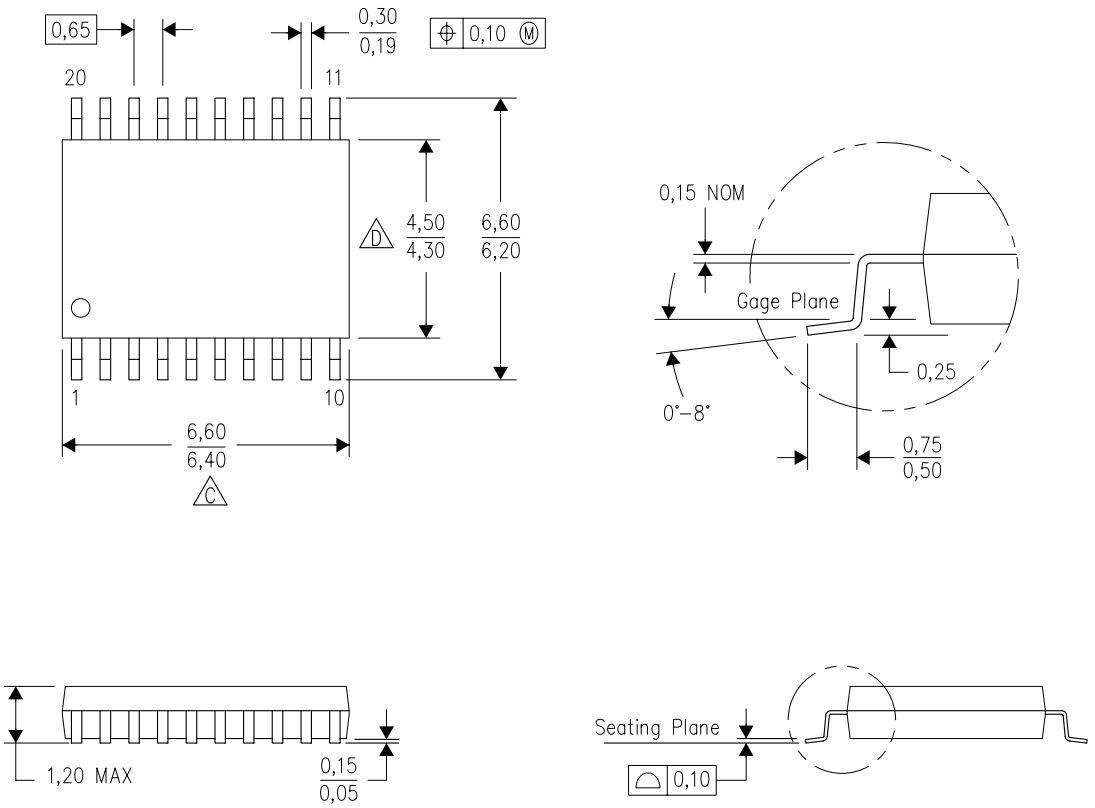
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLC59213AIPWR	TSSOP	PW	20	2000	367.0	367.0	38.0
TLC59213AIPWT	TSSOP	PW	20	250	210.0	185.0	35.0
TLC59213IPWR	TSSOP	PW	20	2000	367.0	367.0	38.0

PW (R–PDSO–G20) PLASTIC SMALL OUTLINE



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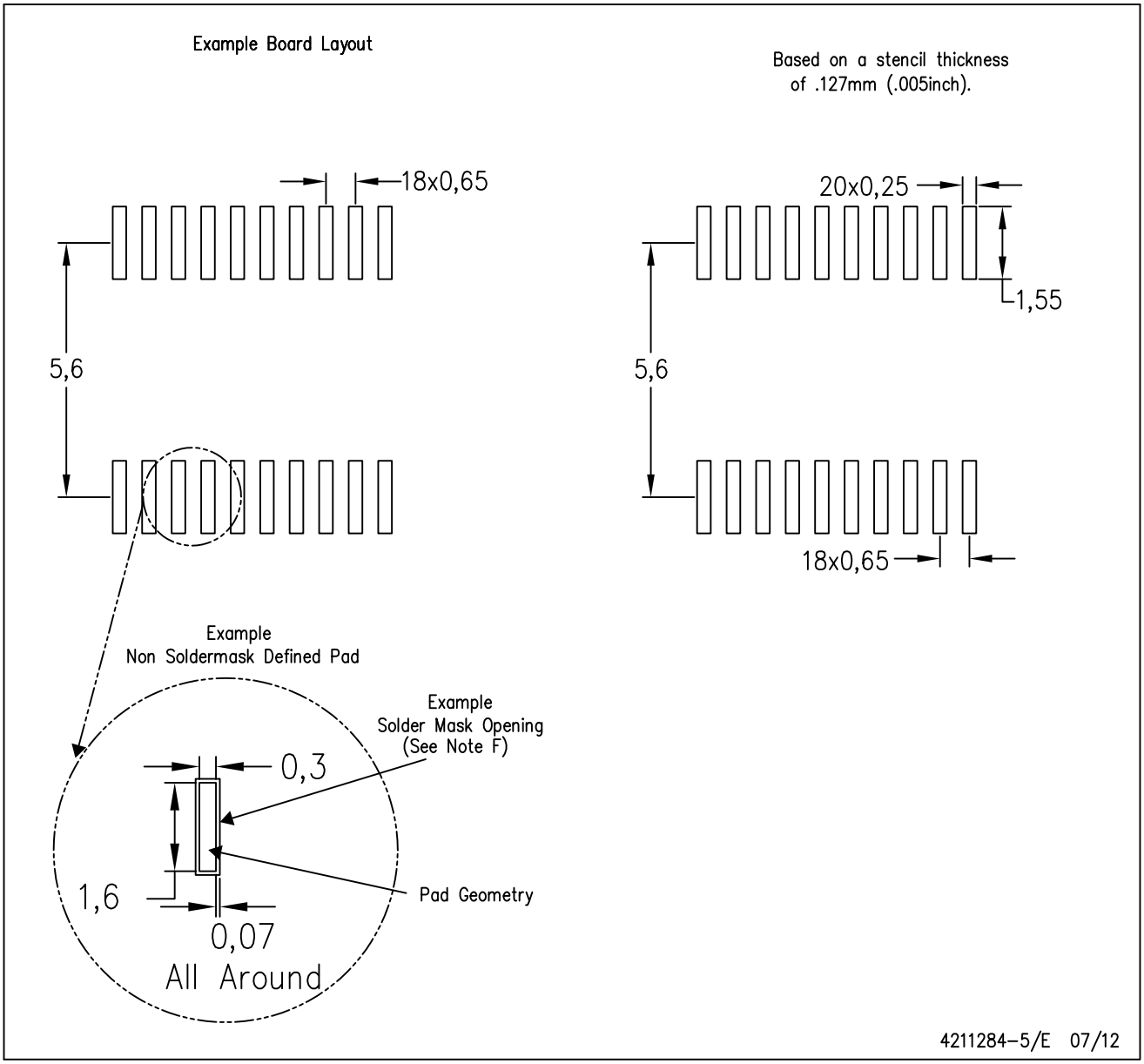
NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO–153

PW (R–PDSO–G20) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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